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Patentanmeldung Nr. Patent application No. Demande de brevet n°

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Pad support for a beverage maker, foam unit and beverage maker including such a pad support and method for preparing a beverage with a foam layer using such a pad support

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Pad support for a beverage maker, foam unit and beverage maker including such a pad support and method for preparing a beverage with a foam layer using such a pad support

The invention relates to a pad support according to the introductory portion of claim 1, to a foam unit and to a beverage maker including such a pad support and to a method for preparing a beverage using such a pad support.

A pad support of the above-identified type is known from European patent application 0 904 717. The pad support described in this document bounds a brewing chamber and includes a plurality of studs. Distal ends of the studs support a filter wall of the pad or pouch keeping a granulate or powder – here ground coffee - from following the water that is pressed through the brewing chamber.

The jet of beverage liquid – here coffee extract - spouting through the nozzle causes the formation of bubbles in the coffee extract when the jet hits beverage liquid collected downstream of the nozzle. This results in a layer of foam on the beverage.

Coffee makers (apparatus for preparing coffee extract from water and roasted and ground coffee) including such a pad support for forming foam on coffee extract are generally effective for forming foam at much lower pressures (for instance less than 3 bar and preferably about 0.8-1.6 bar) than those typically employed in espresso apparatus and can therefore be manufactured at much lower cost.

A problem of such apparatus is that sometimes tears occur in the pad closely to the discharge opening. This causes the discharge opening to clog up with ground coffee so that the dispensing of coffee extract is blocked. The ruptured filter pad then needs to be removed and the pad support must be cleaned. The coffee making process is thereby terminated without having provided to the expected amount of coffee extract and the removal of loose ground coffee and coffee extract that had been prevented from leaving the brewing chamber is cumbersome.

It is an object of the invention to provide a solution which, at a given strength of the filter wall of the pad and a given pressure drop over the filter wall reduces the risk of

the occurrence of tears in the filter wall and/or allows the pressure drop to be increased and/or the filter wall strength to be reduced without increasing the risk of filter wall rupture in an area closely to the discharge opening, and to achieve this without substantially reducing fineness and durability of the foam on the beverage.

According to the present invention, this object is achieved by providing a pad support according to claim 1. Furthermore, according to the invention, this object can be achieved by providing a foam unit according to claim 12 that includes a pad support according to claim 1, in a beverage maker according to claim 13 that includes a foam unit according to claim 12 and in a method for making a beverage according to claim 14 in which a pad support according to claim 1 is used.

Because, seen in top plan view towards the bottom of the pad support, at least some of the innermost plurality of support projections have a cross-section elongate in a direction radial to the discharge opening, the innermost plurality of support projections can be positioned closer to the discharge opening, and thereby provide better support for the pad, without causing or increasing turbulence in the extract flow directly upstream of the nozzle, which would cause the fineness and durability of the obtained foam to suffer. Also, an increase in the volume between the pad and the nozzle, as would for instance occur if the nozzle would be positioned in the discharge opening in a position spaced from and below the bottom, while innermost ones of the support projections project from the discharge opening or from a shoulder in the discharge opening, is avoided.

The beverage to be prepared using the present invention will mostly be coffee. However, use of the invention in the preparation of other drinks involving the passage of liquid through a supported filter wall, such as chocolate milk and other milk drinks, is also possible.

Particularly advantageous embodiments of the invention are set forth in the dependent claims.

Further features, effects and details of the invention are described with reference to the embodiment shown in the drawings.

Fig. 1 is a side elevational view in cross-section of an example of a coffee maker according to the present invention including an example of a pad support according to the present invention;

Fig. 2 is an enlarged view of a coffee brewing chamber of the coffee maker according to Fig. 1,

Fig. 3 is a top plan view of the pad support of the coffee maker according to Figs. 1 and 2;

Fig. 4 is a side view in cross-section along the line IV-IV in Fig. 3;

Fig. 5 is a side view in cross-section of an alternative example of a pad support according to the invention; and

Fig. 6 is an enlarged view in cross-section along the line IV-IV in Fig. 3 of the nozzle area of the pad support according to Figs. 1-4.

In Fig. 1, reference numeral 1 designates a coffee maker according to the invention for preparing coffee extract having a small-bubbled foam layer.

The coffee maker 1 has a housing 2 and a cover 3 hinged to the housing 2 by a hinge 4 and fixed in closed position by a latch 10. The housing 2 has a forwardly extending portion of which a top surface 5 forms a plateau for supporting one or more cups 6 to be filled with coffee. Within the housing, a water reservoir 7 is located which is open at a top end 8 when the cover 3 is open and closed when the cover 3 is in the closed operating condition shown in Fig. 1. A conduit 9 extends through a heating chamber 46 in which an electric heating element 47 is arranged. For supplying water from the reservoir 8, a pump 45 is arranged in the conduit 9 upstream of the heater 47.

A sprinkling head 11 is integrated in a top wall 12 of a brewing chamber 13 and forms the end of the conduit 9. The top end of a pad support 15, which is also shown separately in Figs. 3 and 4, forms a bottom 14 of the coffee brewing chamber 13 (see also Fig. 2). Support stubs 16, 17 project from the bottom and interspaces between these projections 16, 17 allow beverage liquid – according to the present example coffee extract - pressed out of a pad or pouch 18 containing a ground coffee granulate or powder and supported above the bottom 14 to flow to a discharge opening 19 between the pad 18 and the bottom 14. The pad support 15 is supported by a brewing chamber housing part 20, which in turn is supported by portions of the main housing 2 of the coffee maker 1. In operating condition, the brewing chamber 13 is watertightly sealed by seals 21, 37 so that no significant loss of pressure generated by the pump 45 occurs and all or virtually all pressure generated by the pump 45 is applied to the brewing chamber 13 when coffee is being extracted. Of other drinks than coffee are to be prepared, the pad may for instance contain other

substances, such as cocoa powder and/or milk powder which may be flavored and/or sweetened.

A nozzle 22 of which an upwardly oriented face forms part of the bottom 14 restricts the cross-section of the discharge opening 19 available for the passage of coffee extract. The nozzle 22 may also be an integral part of the pad support 15.

The discharge opening 19 debouches into a dispersing chamber 36 that communicates with two dispensing channels extending through dispensing spouts 38 via which coffee extract dispersed in the chamber can flow to the cups 6 on the platform 5.

For forming foam on a coffee extract, the coffee extract is jetted from the nozzle 22 into a buffer quantity of coffee extract in the buffer reservoir 36.

As is best seen in Figs. 2-4, the pad support projections 16, 17 include an innermost plurality of the support projections 17 projecting from the bottom 14 at positions circumferentially distributed around the discharge opening 19. Seen in top plan view towards the bottom, as in Fig. 3, the innermost ones 17 of the support projections 16, 17 have a cross-section elongate in a direction radial to the discharge opening 19. This allows the innermost ones 17 of the support projections 16, 17 to be positioned closer to the discharge opening 19, and thereby provide better support for the filter pad 18 in the area of the discharge opening, than would be possible if the innermost ones of the support projections would have a conventional round cross-section, without causing turbulence in the coffee extract flow directly upstream of the nozzle 22 , at least to such an extent that the fineness and durability of the obtained foam suffers.

It has been found that it is advantageous for obtaining fine, stable, "crema"-like foam on the coffee if the coffee extract reaches the nozzle 22 from which it is jetted into coffee in the buffer reservoir 36 as a laminar flow. Various further features can be provided to promote this effect, without entailing a substantial increase of the free volume between the filter pad 18 and the pad support 15, which would result in an increase in the amount of coffee extract that may be left in this volume after brewing , especially if relatively small amount of coffee extract are prepared.

For further counteracting turbulence, it is for instance advantageous that the largest widths of the innermost projections 17 is located radially outside of the middle of the length thereof in a direction radial to the discharge opening 19. Preferably, the largest width will be at 60 to 75 % of the length of the cross-section if measured radially in outward direction.

Another feature which further helps against turbulence in the area upstream of the nozzle 22 is that the elongate cross-sections each have an innermost end 23 that is sharper than and the opposite, outermost end 24.

For improving the stability of the foam, it is further advantageous if, neighboring ones of the innermost plurality of support projections 17 have straight wall portions 25, 26 facing each other and bounding a passage 27 between the neighboring projections 17 having a width "a" which is constant or decreases in radial direction towards the discharge opening 19..

More specifically, it is particularly advantageous for counteracting turbulence in the area upstream of the nozzle 22 if the elongate cross-sections of the innermost support projections 17 are of a wing or droplet-shaped form.

The distal ends of the support projections 16, 17 define a support bed 30 along which the pad, or at least the lower wall of a filter pad 18 extends when supported by the support projections 16, 17. In the present example, this support bed 30 is flat. However, other shapes, such as slightly curved or conical are also conceivable.

In particular in combination with innermost support projections 17 having a cross-section elongate in radial direction towards the discharge opening 19, but also if combined with innermost support projections of any other shape, it is advantageous for counteracting turbulence in the area upstream of the nozzle 22 if, at least over a ring-shaped portion 28 of the bottom 14 surrounding the discharge opening 19 and radially spaced from the outermost circumference 29 of the bottom 14, the distance between the bottom 14 and the support bed 30 increases radially towards the discharge opening 19. This causes the coffee extract flow velocities in the center area of the pad support, where the flow velocities can be high enough to cause turbulence, to be reduced due to the increased cross-section through which the coffee-extract flows to the area upstream of the nozzle 22.

In order to selectively reduce flow velocities where turbulence is likely to occur and can affect foam formation, the bottom 14 surrounding the discharge opening 19 slopes steeper in the ring-shaped portion 27 thereof than in portions of the bottom 14 located radially outside of the ring shaped portion 14.

Since the innermost ones 17 of the support projections 16, 17 project from the ring-shaped bottom portion 27, the flow velocities are reduced particularly in the passages between the circle of innermost support projections 17 in which passages the flow velocities are highest and before turbulence can be caused due to too fast outflow into the central area inside the circle of support projections 17.

It has further been found that it is advantageous for creating stable, fine foam if a contraction process is caused where the coffee flow enters the nozzle 22. To this end, it is preferred that, in the ring-shaped portion 27 of the bottom 14 surrounding the discharge opening 19, the bottom 14 also slopes steeper than in bottom portions 31 (including the upwardly oriented face of the nozzle 22) between that ring shaped portion 27 and the discharge opening 19. According to the present example, this effect is particularly strong because the bottom 14 has a flat portion 31 between the sloping, ring-shaped portion 27 and the discharge opening 19.

The contraction and its effect are illustrated in more detail in Fig. 6. In an area surrounding the discharge opening 19 and radially spaced therefrom, a flow 32 of coffee extract flows radially towards the discharge opening 19 as indicated by broad arrows 33. More inwardly, in the area of an upstream edge 34 of the discharge opening 19, the coffee flow 32 bends around that upstream edge of the discharge opening 19 as is indicated by groups of arrows 35. Due to the inward radial velocity of the coffee flow 32 in the area of the upstream edge 34 of the discharge opening 19, the coffee flow 32 does not follow the nozzle surface into the discharge opening 19, but separates from the nozzle surface at the upstream edge 34 of the discharge opening 19. Thus, the upstream edge 34 of the discharge opening 19 effectively forms a separation edge where the coffee flow 32 comes off the nozzle surface.

This brings about that, in the discharge opening 19, the coffee flow 32 forming a jet 39, is not in contact with the internal surface of the discharge opening 19. Accordingly, it is not disturbed by hydrostatic and hydrodynamic drag along that surface, so a smooth jet 39 is obtained which has been found to be very effective for causing the coffee extract to foam up when it hits the surface of a pool of coffee extract collected below the nozzle 22. It will be clear that a smooth laminar flow in the coffee extract reaching the discharge opening is important for a continuous, effective separation at the upstream edge 34 of the discharge opening 19 resulting in a smooth jet 39 of constant power and fineness hitting the pool of coffee extract collected downstream of the nozzle and thereby causing the formation of even, fine foam on the coffee extract.

From a manufacturing point of view, it is advantageous, that for obtaining a smooth jet, only the separation edge 34 needs to be sharp and smooth and manufactured to relatively tight tolerances. The internal surface of the discharge opening 19 and the downstream end of the discharge opening can be manufactured to relatively loose tolerances and do not need to be particularly smooth. Such needs are particularly well matched by the characteristics of metal stamping, which allows producing nozzles at very low cost and at a

high production rate. When stamping out the discharge nozzle using a punch entering the metal blank from the side intended to form the upstream side of the nozzle, a smooth separation edge 34 of exact, preferably, flat, circular shape can be obtained relatively easily. Over about two thirds of the height of the hole for forming the discharge opening 19 the punch cuts through the metal providing a relatively smooth surface, so that contact with the coffee jet 39 passing closely by the upstream area of the internal surface of the discharge opening is ensured. Over about the last third of the height of the hole for forming the discharge opening, the metal is sheared of in a less orderly fashion which results in a relatively rough surface and the formation of a burr. However, within relatively easily maintainable tolerance limits, such imperfections do not disturb the coffee flow 32, which passes, spaced relatively remote from the downstream portions of the internal wall of the discharge opening 19.

To provide an effective flow separation at the leading edge 34 of the discharge opening, that edge is preferably sharp. The sharpness achievable by punching from the upstream side without post processing of the edge to make is more or less sharp is usually sufficient. A suitable sharpness can also be achieved in other manners, for instance by drilling, grinding or by die cast molding or injection molding of the nozzle. If the nozzle can also be made from ceramic material fine enough to provide the required smoothness of the upstream separation edge 34.

To avoid that the jet 39 contacts the internal; surface of the discharge opening in an area spaced downstream from the separation edge 3, the height of the discharge opening 19 is preferably smaller than its smallest cross-sectional width and more preferably smaller than half of its smallest cross-sectional width. According to the presently most preferred example, the discharge opening 19 has a diameter of 0.6 to 1.0 mm and a height of 0.2 to 0.4 mm and the radius of the separation edge 34 is preferably less than 0.1 mm. If the discharge opening 19 flares outwardly towards its downstream end, instead of being of constant cross-section as in the present example,, it can be longer without causing contact between the jet 39 and its internal surface.

In Fig. 5 an alternative example of a pad support 65 according to the invention is shown. According to this example, the bottom 64 gradually slopes inwardly and away from the distal ends of the support projections towards a ring shaped portion 77 where the bottom 64 slopes steeper to reduce flow velocities with which the coffee extract flows out towards the area upstream of the nozzle 72. The nozzle 88 has a flat upstream face 81, which forms a

flat innermost portion of the bottom 64, so that an effective, foam enhancing contraction of coffee extract immediately upstream of the nozzle 22 is achieved.

CLAIMS:

1. A pad support for a beverage maker, including a bottom forming a barrier for beverage liquid flowing out of a supported pad, a discharge opening in said bottom for discharging beverage liquid through said bottom and a nozzle restricting said discharge opening for generating an beverage liquid jet out of said nozzle, and a plurality of pad support projections including an innermost plurality of said support projections projecting from said bottom at positions circumferentially distributed around said discharge opening, characterized in that, seen in top plan view towards said bottom, at least some of said innermost plurality of support projections have a cross-section elongate in a direction radial to said discharge opening.

2. A pad support according to claim 1, wherein said elongate cross-sections each have a length in a direction radial to said discharge opening and have a largest width located radially outside of the middle of said length in a direction radial to said discharge opening.

3. A pad support according to claim 1 or 2, wherein said elongate cross-sections each have an innermost end and an outermost end, the innermost end being sharper than the outermost end.

4. A pad support according to any one of the preceding claims, wherein neighboring ones of said innermost plurality of support projections have straight wall portions facing each other bounding a passage between said neighboring projections having a width which is constant or decreases in radial direction towards said discharge opening.

5. A pad support according to any one of the preceding claims, wherein said cross-sections elongate in a direction radial to said discharge opening are wing or droplet-shaped.

6. A pad support according to any one of the preceding claims, wherein distal ends of said support projections define a support bed for supporting said pad, wherein said

bottom has an outermost circumference and wherein, at least in a ring-shaped portion of said bottom surrounding said discharge opening and radially and inwardly spaced from said outermost circumference, the distance between said bottom and said support bed increases in radially towards said discharge opening.

7. A pad support according to claim 6, wherein, in said ring-shaped portion of said bottom, said bottom slopes steeper than in bottom portions radially outside of said ring-shaped bottom portion.

8. A pad support according to claim 6 or 7, wherein said innermost plurality of support projections project from said ring-shaped bottom portion.

9. A pad support according to any one of the claims 6-8, wherein, in said ring-shaped portion of said bottom surrounding said discharge opening, said bottom slopes steeper than in bottom portions between said ring shaped portion and said discharge opening.

10. A pad support according to any one of the claims 6-8, wherein said bottom has a flat portion between said ring shaped portion and said discharge opening.

11. A pad support according to any one of the preceding claims, wherein the discharge opening has a sharp upstream separation edge forming a transition form said bottom to said discharge opening for causing separation of beverage liquid from the discharge opening as the beverage liquid flows into the discharge opening.

12. A foam unit including a pad support according to any one of the preceding claims and a the buffer reservoir positioned downstream of the nozzle, for retaining a buffer quantity of beverage liquid such that, in operation, beverage liquid is jetted from the nozzle into the buffer quantity of beverage liquid.

13. A beverage maker comprising:

a water heating and feeding structure communicating with a brewing chamber for feeding hot water under pressure towards said brewing chamber;

a foam unit according to claim 12; and

a beverage dispensing passage communicating with said buffer reservoir,

wherein the pad support bounds a bottom side of said brewing chamber.

14. A method for preparing a beverage with a foam layer, comprising forcing water through a granulate or powder upstream of a filter wall of a pad, and receiving the beverage from the pad using a pad support according to any one of the claims 1-11, the beverage liquid flow being such that in an area directly upstream of said discharge opening a laminar flow pattern is obtained.

ABSTRACT:

A pad support (15) for a beverage maker, includes a bottom (14;64) forming a barrier for beverage liquid flowing out of a supported pad (18), a discharge opening (19) in the bottom (14;64) for discharging beverage liquid through the bottom (14;64) and a nozzle (22;72) restricting the discharge opening (19) for generating a beverage liquid jet out of the nozzle (22;72), and a plurality of pad support projections (16, 17) including an innermost plurality (17) of the support projections projecting from the bottom (14;64) at positions circumferentially distributed around the discharge opening (19). Seen in top plan view towards the bottom (14;64), at least some of the innermost plurality of support projections (17) have a cross-section elongate in a direction radial to the discharge opening (19). A foam unit, a beverage maker (1) and a method using such a pad support (15;65) are also described.

Fig. 3

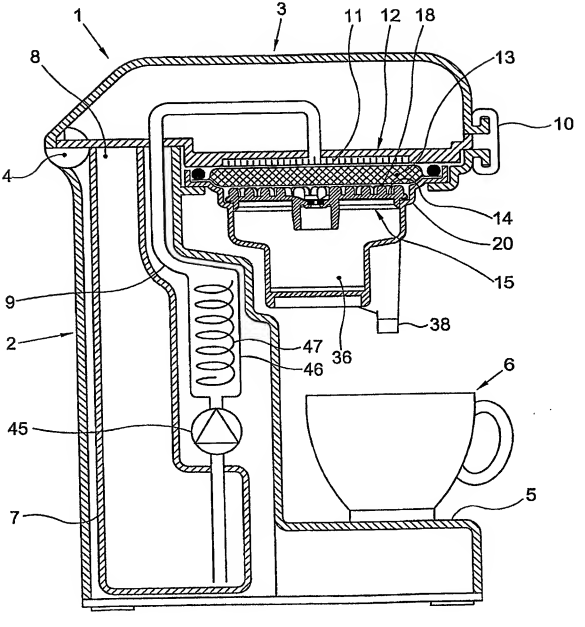

FIG. 1

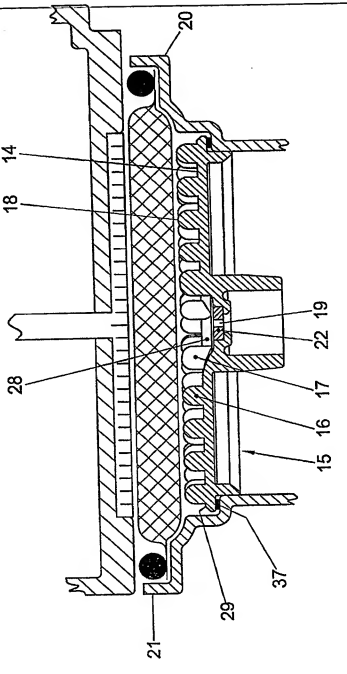

FIG. 2

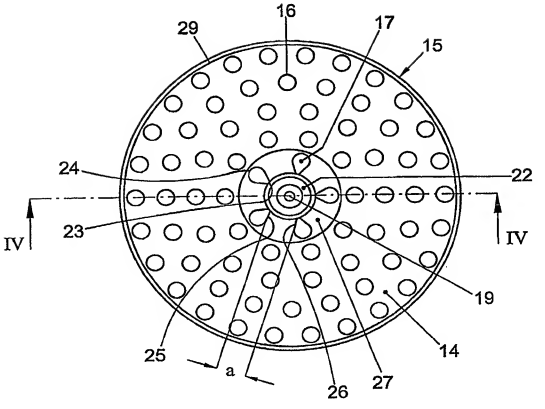

FIG. 3

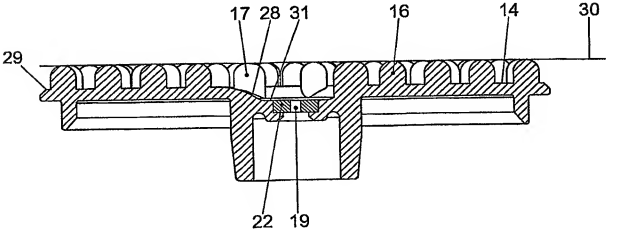

FIG. 4

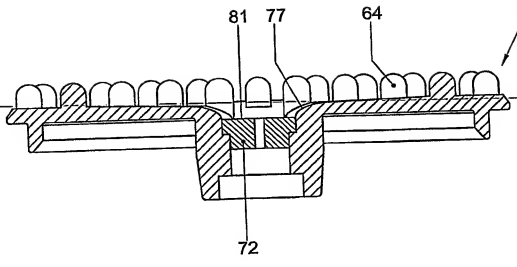

FIG. 5

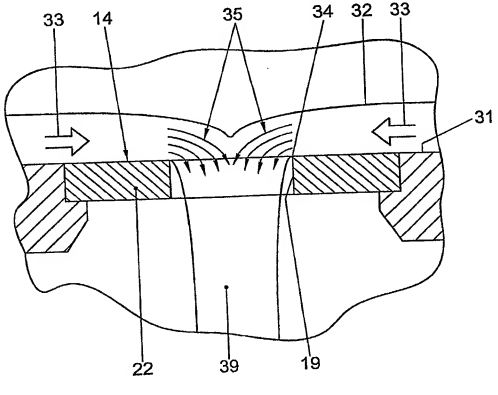

FIG. 6

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